16-3315A

GOUVERNEMENT DU QUEBEC

DEPARTMENT OF EDUCATION

GENERAL DIRECTORATE OF
ELEMENTARY AND SECONDARY
EDUCATION

CURRICULUM SERVICE

MATHEMATICS 552
(code 711-552)

Revised syllabus

JULY, 1973

LEGAL DEPOSIT - 4th Quarter 1975
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20/09/2006 29.6-16-3315A

SYLLABUS FOR MATHEMATICS 552 Gr. 1

UNIT I

A. 1. To add, multiply by a scalar, multiply together matrices of suitable orders and to verify the properties of these operations with given specific matrices.

2. To evaluate the determinant of a given 2x2 or 3x3 matrix, and to find the multiplicative inverse of a 2x2 and 3x3 matrices.

3. Cramer's Rule and applications to solving systems of linear equations.

4. To perform routine calculations involving vector addition, multiplication by a scalar, inner product, outer product.

5. To determine the angle between two non-zero vectors.

6. To determine direction cosines and/or direction numbers for a given vector.

7. (a) To obtain the area of a triangle determined by 3 points, or 2 vectors.

(b) To obtain area of a parallelogram determined by 2 vectors.

(c) To obtain volume and surface area of a parallelepiped determined by 3 vectors.

8. To determine the sine of the angle between 2 vectors using outer product.

9. To obtain unit vectors parallel to a given vector.

10. Linear dependence and independence.

11. To prove the following theorems:

(a) $\{A,B\}$ is lin. dep. iff $A \| B$, where A, B are vectors.

(b) $\{A,B,C\}$ is lin. dep. iff A,B,C are coplanar, where A,B,C are vectors.

(c) $A.B = |A|\,|B| \cos \theta$, where A,B are non-zero vectors and θ is the angle det'd by A and B.

(d) $A \perp B$ iff $A \cdot B = 0$, where A,B are vectors.

(e) $|A \times B| = |A|\,|B| \sin\theta$, where θ is the angle between A and B.

(f) $A \times B = 0$ iff $A \| B$.

(g) Other routine proofs depending on direct calculations. Eg. AxB = -BxA, etc.

B. 1. Definition of vector space - by listing of properties

- polynomials
  & n-tuples
  matrices
  complex numbers

} as examples

2. Notions of subspace, basis & dimension.

UNIT II

A. 1. Lines in the Plane and in Space

Given any two points in space $A(x_o, y_o, z_o)$ and $B(x_1, y_1, z_1)$.

Find the equation of the line through A and B. Express the equation in parametric form:

$x = x_o + at$ $\qquad$ $y = y_o + bt$ $\qquad$ $z = z_o + ct$

or symmetric form:

$$\frac{x - x_o}{a} = \frac{y - y_o}{b} = \frac{z - z_o}{c}$$

Given a point and the direction (a vector) of a line, determine its equation in vector form.

Given a line in space, state its direction numbers and direction cosines.

Find the angle between two lines in space.

Determine the point of intersection of two lines.

Determine whether two lines are parallel or perpendicular.

Given a line and a point, find in two or three dimensions:

(a) a line parallel to the given line through the given point,

(b) a line perpendicular to the given line through the given point,

(c) find the distance between the point and the line.

Given two points, find the distance between them.

Given two lines, find the distance between them.

Given a line, construct algebraically the family of lines through this point.

B. The Plane in Space

Given 3 points, determine the equation of the plane in

(a) parametric form

(b) vector form

(c) general form $ax + by + cz = d$

Given two planes; find the angle of intersection, and the equation of the line generated by them.

Find the distance

(a) of a point from a plane

(b) between parallel planes

(c) between a plane and a line parallel to it.

C. Conics:

(a) Derivation of equations of ellipse, parabola and hyperbola.

(b) Given a second degree equation, to determine type of conic represented by it, and to find its centre, vertices, foci, directrices, latus rectum, and tangents at given points.

(c) Illustration by matrices of transformations in the plane--translations, rotations and dilations.

UNIT III

1. Linear Programming

2. The Simplex Method --a brief introduction

3. Solutions of problems in business, e.g. transportation problems, cost minimizing, by linear programming.

Suggested Reference Texts for Linear Programming and the Simplex Method:

1. "Introduction to Linear Programming", W. A. Spivey, MacMillan

2. "Elementary Matrix Algebra with Linear Programming", Paintar and Taris.

3. "An Introduction to Matrices, Vectors and Linear Programming", Campell, Appleton, Century, Crofts.

DISTRIBUTION OF THE PROGRAMME OVER 32 WEEKS

Note: The following is a suggested distribution only. Among other things it is intended to serve as an indication of the relative importance of the various sections of the course. Where necessary, it would be preferable to drop certain concepts of a given section rather than devote more time to that section than is indicated below.

The numerals in the chart below indicate the number of weeks to be devoted to each section.

		Number of Weeks
Unit I	Section A	12
	Section B	4
Unit II	Section A	4
	Section B	5
	Section C	3
Unit III		4

A P P E N D I X

HIGHLIGHTS OF THE REVISED MATHEMATICS 552 SYLLABUS

This is a comparison between the content of the revised syllabus for Math 552 (July 1973) and the present Math 552 syllabus (March 1972).

A) DELETIONS

The following sections have been deleted from the programme :

Chapter 1, no. 6 — To prove simple geometric theorems by Vector Methods.

Part II, no. 3
- B - Quadric Surfaces
- C - Polar Co-ordinates
- D - Parametric equations

B) UNCHANGED CONTENT

The content of Units I and II is essentially that of the present syllabus, with the topics rearranged as indicated below.

Revised Syllabus:			Present Syllabus	
Unit I.			Chapter	1
A.	1.		"	7
	2.	(Note: addition of multicative inverses for 3X3 matrices.)	"	8
	3.	*		
	4.		"	3
	5.		"	4
	6.		"	5
	7.		"	10
	8.		"	11
	9.		"	12
	10.		"	2(a)
	11.		"	11

Unit 1 - B

1. 1

2. *

Unit 2

A - 1.			Part 2. 1
B	1.		" 2 - 2
C	1	a and b	" 2 - 3
C	1	c*	

C) NEW CONTENT

The following selections have been added to the programme.

UNIT 1

A. 3. Cramer's rule and applications to solving systems of linear equations.

A. 10. (Chapter 1. 2(a))
Linear dependence and independence.

B. 2. Notions of subspace, basis and dimension.

UNIT III

A. 1. Linear Programming

2. The simplex method - a brief introduction

3. Solutions of problems in business, eg: transportation problems, cost minimizing, by linear programming.

SUMMARY:

The revised syllabus reflects a change in emphasis to be placed on the teaching of Vectors, Vector Spaces and Subspaces, together with the introduction of Linear programming and the application of the Simplex method to Linear programming. There is a de-emphasis on the study of the conics.

L'ÉDITEUR OFFICIEL DU QUÉBEC
SERVICE DE LA REPROGRAPHIE
Octobre 1975